Portland Sustainable Consumption and Production Report Appendix

Methodology and Multnomah County Consumption-based Emissions Inventory

September 2021

THE BUREAU OF
PLANNING &
SUSTAINABILITY

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Sustainable Consumption and Production Report Methodology

This Appendix reviews the methodology used to narrow the focus from the full consumption-based emissions inventory (CBEI) to a Report and Two-year Workplan focusing on upstream production-phase emissions, the role of local government, and use of the *Doughnut Economics* framework.

The Appendix also includes the Multnomah County Consumption-based Emissions Inventory for 2011 and 2015, including detailed tables focused on upstream emissions.

Identifying key categories of consumption

Portland's CBEI includes all consumer spending on 536 different commodities. As a result, it includes everything in the economy. The Sustainable Consumption and Production Report and Two Year Workplan (SC&PR) focuses on key categories of consumption. To identify these categories, City of Portland staff considered the difference between the lifecycle phases that were well understood versus those that were more emergent for cities. For the last 25 years, Portland has worked to reduce use- and disposal-phase emissions through climate action planning and the Portland Recycles! Plan. As of 2018, Portland had reduced total emissions from households and businesses by 42% per person from 1990 levels. Disposal-phase emissions have been reduced by 84% since 1990 due to methane capture at landfills and investments in waste reduction activities that divert solid wastes from landfills, like recycling and composting. The City has an ongoing commitment to bring use and disposal phase emissions to net-zero by 2050.

In contrast, the analysis that informs the SC&PR focuses on emissions resulting from upstream lifecycle phases, including production, pre-purchase transportation, and retail and wholesale distribution. These are the new emergent areas of focus for cities. These lifecycle emissions are less understood at the local level and often occur in other parts of the world, where Portland's local government has less direct control. The focus on upstream emission sources is not intended to diminish the importance of reducing use- and disposal-phase emissions. The intent of the SC&PR is to be strategic about new areas for intervention. As such, this first SC&PR does not focus on transportation, even though it remains a primary source.

In reordering CBEI data based on total emissions from the production lifecycle phase (see Table 1), categories of consumption that have the greatest upstream emissions rise to the top. For example, in the full CBEI data, "Vehicles and parts" are the largest source of emissions. However,

82% of those emissions are from the use phase of those vehicles, not the embodied carbon in the vehicle itself. If the CBEI data is sorted instead by the production lifecycle phases, "Vehicles and parts" and "Appliances" fall below "Food and beverages" and many other categories. Given this, the SC&PR prioritizes efforts to reduce consumption-based emissions from upstream lifecycle phases by focusing on Food and beverages, Services, Construction, Healthcare and Other Manufactured Goods. For Manufactured Goods, we have also included Clothing, Furnishings and Supplies, Electronics, and Retailers, because of similar opportunities for local government intervention.

Table 1: Comparison of consumption-based emissions from Multnomah County comparing total lifecycle emissions to production-phase emissions,

Rank	CATEGORY	Total GHG Emissions*
1	Vehicles and parts	3,018.2
2	Food and beverages	2,490.6
3	Services	2,290.6
4	Appliances	1,863.0
5	Construction	1,557.6
6	Healthcare	1,265.5
7	Other manufactured goods	1,071.3
8	Transportation services	1,020.0
9	Retailers	714.2
10	Furnishings and supplies	670.5
11	Electronics	625.1
12	Other	447.8
13	Clothing	246.0
14	Wholesale	237.0
15	Lighting and fixtures	232.1
16	Water and wastewater	92.2
	TOTAL	**17,841.8**
	*1000 Metric Tons CO2e	

Rank	CATEGORY	Production Phase Emissions*
1	Food and beverages	2,271.6
2	Services	2,148.6
3	Construction	1,413.3
4	Healthcare	1,192.0
5	Other manufactured goods	1,007.3
6	Furnishings and supplies	613.0
7	Vehicles and parts	521.5
8	Retailers	464.3
9	Other	384.6
10	Electronics	345.8
11	Clothing	244.3
12	Wholesale	148.5
13	Transportation services	139.0
14	Water and wastewater	91.6
15	Appliances	65.4
16	Lighting and fixtures	12.1
	TOTAL	**11,062.9**

The SC&PR also includes a focus on government operations, due to the City's direct control over purchasing decisions. This work is informed by a supply chain analysis completed by Trucost.[1] This sustainable supply chain analysis was conducted for purchases made by the City in fiscal year (FY) 2014–15 and looked at the lifecycle emissions produced as a result of City spending.

This focus is a starting point to prioritize near-term actions. In the future this work will need to expand to address the correlations with use and disposal phase emissions. For example, as Portlanders transition from gas- to electric-powered vehicles, the City plays an important role in reducing the need for car ownership overall. The work at the Portland Bureau of Transportation to increase bicycle and transit ridership and work at BPS on land use planning remain key.

Furthermore, not all the reductions in use- and disposal-phase emissions can be explained by local conservation and renewable energy investments, as offshoring of local production

contributes to local emissions reductions. The differentiation between production and use/disposal-phase emissions is more nuanced. It is important to acknowledge that both production and use-phase emissions are reduced by shifts to renewables and improved energy efficiency, particularly where goods produced locally are consumed locally. Therefore, there is a strong linkage between sector-based emissions and consumption-based emissions. This work will need to continue to be closely linked in the future.

Reviewing data to identify strategies

In 2019, BPS convened workgroups with bureau staff and some external partners for each of these categories discussed above. Workgroups reviewed the CBEI data and developed strategies to reduce emissions. This rich data is broken out by each of the different commodities in the CBEI. Emissions within each category were analyzed by geographic location and source of demand. This enabled staff to identify strategies by considering where the emissions were being produced (Oregon, rest of the United States or other countries) and by who created the demand for that consumption (households, government, or businesses).

Strategies were developed by considering the primary mechanisms for reducing these emissions in terms of both supply- and demand-side interventions. For example, the data showed that red meat and dairy had the highest carbon intensity for emissions from food. This led to setting a strategy and developing actions that reduce emissions from red meat and dairy production. In addition, there is tremendous opportunity to reduce upstream emissions from food production by reducing the amount of food that goes to waste. Research shows that up to 40% of food in the United States is wasted.[2] This indicated the need to go beyond food scrap collection for composting (an end-of-life materials management strategy) to prevent the wasting of food through interventions that occur before the food is ever purchased by a consumer (upstream interventions).

In addition, the workgroups considered the *Doughnut Economics* framework that helps us understand that some households need to consume more to meet their basic needs. There are many opportunities to support low-income households in meeting their basic needs. Opportunities include redirecting nutritious food to some of the 42 million Americans that live in food-insecure households rather than tossing it in the landfill.[3] In addition, low-income and other vulnerable communities can benefit from the economic benefits of local agriculture and the improved access to low-carbon and nutritional foods. At risk of oversimplifying the issues by linking food waste with hunger, it is important that these are understood as two distinct systemic problems that require separate solutions. While there are benefits to re-routing excess

food for short term hunger-relief programs, this is only a band-aid solution, and long-term hunger relief requires dismantling systems of oppression and exclusion that cause barriers to employment, education, housing, and healthcare. Not all food-related carbon reduction strategies reduce hunger, and not all hunger-reduction strategies reduce carbon emissions.[4] The sweet spot is to identify strategies that do both. Strategies that are inclusive of the *Doughnut Economics* framework not only reduce overall emissions, but also provide Portland's shortfall consumers with opportunities to increase community resilience, health and wellbeing, while moving toward dismantling the systems of oppression that have created inequitable conditions.

Developing actions and applying the Doughnut Economics framework

After establishing high-level, directional, and longer-term strategies, staff and workgroup members set out to identify what actions BPS and partners could take to begin achieving these strategies. The first step was to explore the breadth of possible interventions. The following list highlights the types of actions the City considered to address consumption:

- Procurement and purchase power
- Market transformation
- Regulation
- Technical assistance
- Convene stakeholders
- Partnerships
- Recognition
- Pilots and demonstrations
- Incentives and penalties
- Administrative process and fees
- Tax policy
- Land use planning
- Community education and outreach
- Behavior change campaigns
- Information policy
- State and Federal policy advocacy
- Investment
- Research

After research and consultations with partners and community members, the workgroups brainstormed actions using a *Doughnut Economics* framework. *Doughnut Economics* focuses on two different areas of consumption — overshoot and shortfall consumers. The SC&PR methodology utilized the *Doughnut Economic* framework to develop actions that supported these consumers and targeted both supply- and demand-sides of the economy, as shown in Table 2 below.

Table 2: Brainstorming matrix used to consider supply- and demand-side interventions for both shortfall and overshoot consumers

	Supply-Side/Production Interventions	**Demand-Side/Consumption Interventions**
Overshoot Consumers: Higher income households Businesses Government agencies	Clean energy investments for local product producers Support for local agriculture, community gardens and farm-to-table programs for low-carbon vegetables Funding for circular economy and local supply chain development	Campaigns to reduce purchase of new goods by participating in the community-based sharing economy Investments in home repair and material reuse and preservation
Shortfall Consumers: Black, Indigenous and other communities of color Houseless communities Services sector workers Low-income households Frontline communities	Job opportunities and hiring requirements for low-carbon industries Funding to scale up local reuse and repair businesses and community-based organizations to create new economic opportunities Funding to support low-carbon food businesses and agricultural endeavors for Black and immigrant communities such as Portland	Expanding access to free and community-based repair and reuse opportunities Funding programs like Community Energy Project low-income home repair services Financial support to expand programs like Free Geek's Earn a Computer program Programs that expand and support Black- and

Seniors and people with disabilities	Mercado and Rockwood Rising	immigrant- owned farms like Mudbone Grown that increase community solidarity, resilience and support for low-carbon agriculture

While SC&PR actions separately address both overshoot and shortfall consumers, both are needed to meet the complexity of Portland's goals. Actions that achieve reductions in consumption-based emissions and equity goals can be achieved through both supply-side and demand-side interventions. BPS staff utilized a brainstorming matrix to help identify solutions that meet the different needs and challenges of shortfall and overshoot consumers (see Table 2).

Overshoot consumers can be targeted through supply-side interventions such as reducing the carbon intensity of local production. Or they can be reached through demand-side interventions such as encouraging higher-income households to buy less and participate in the local repair and sharing economy. Conversely, shortfall consumers can be supported in different ways that help to increase their consumption. For example, through supply-side interventions such as increased economic opportunity for Black and Indigenous communities (creating new jobs in reuse and repair of clothes and furniture) or demand-side interventions such as participation in Free Geek programs that provide digital literacy training on the use of technology and free refurbished computers to address digital inequities.

Ultimately, strategies must seek to not only achieve emission reductions but also improve quality of life and wellbeing, centering on Black and Indigenous communities — those who have faced the greatest inequity by every metric. A dynamic response is required because the challenges are too complex to simply focus on mitigating emissions. One example of the type of balancing required would be an initiative that provides one-to-one match of dollars invested in carbon emissions reductions with dollars invested in the Black community. All actions need to be further vetted and developed by affected communities through outreach and engagement. Portland's community engagement on this work was curtailed by the COVID-19 pandemic. With recovery now occurring community engagement will help to shape and evolve these actions to create greater community benefits into the future.

Action prioritization

Actions were then evaluated and prioritized for inclusion based on a variety of criteria, including per capita emissions by consumption category, where emissions occurred, emission abatement and uptake potential, expected trends, effect on income inequality or equity and the ability of local government to influence outcomes. Portland used a tool developed by the Stockholm Environmental Institute for the Urban Sustainability Directors Network to prioritize actions against this criterion.

The final actions included in the SC&PR were further prioritized due to COVID-19 and the need to begin implementation to inform how Portland can build back better. The revised actions focus on steps BPS can take with its existing authority to begin to shift systems. Actions were prioritized that will have most direct benefits for shortfall consumers, particularly Black and Indigenous communities of color, low-income populations, and those most affected by the COVID-19 economic recession.

Thriving Cities Initiative pilot

Portland is participating in C40's Thriving Cities Initiative (TCI), a C40 pilot program that supports development of the SC&PR. The pilot program is an effort to engage city and community members in a process to co-create solutions for a thriving low-carbon future. Portland is participating in the pilot along with the cities of Philadelphia, Pennsylvania, and Amsterdam, the Netherlands.

Given the increasingly globalized and urban world, the way residents in cities live has far-reaching influence on people and on the planet. Cities hold an important and unique role to ensure that people and the natural environment both thrive, locally and globally. TCI utilizes an engaging workshop format to open new insights and possibilities for transformation, to build models for thriving sustainable communities.

TCI pilot cities are working with various stakeholders and local changemakers on a series of workshops to better understand how to support thriving people in a thriving place, while respecting the wellbeing of the whole planet. This is a collaboration between C40, the Doughnut Economics Action Lab and Circle Economy.

The program brings together a series of workshops with *Doughnut Economics* author Kate Raworth to bolster the work outlined in the SC&PR. The TCI program is intended to be a part of Portland's engagement on sustainable consumption and will help to round out the City-led actions identified in the SC&PR with co-created strategies identified through these community workshops.

Using the doughnut to measure success – the four lenses

The *Doughnut Economics* framework is global in nature and needed to be adapted to apply global boundaries to the local level. With adaptation, the framework can help to measure progress from local actions. Portland's work with Raworth and her team through TCI provided helped develop an approach to accomplish this.

The TCI team developed a City Portrait for Portland with four different lenses that align with the ceiling and floor of the *Doughnut Economics* model. There are two social lenses: one for local social foundation, and one for the global social foundation. In addition, there are two environmental lenses: one for local environmental ceiling and one for the planetary boundaries. Each lens has proposed indicators to measure progress. Actions can be tested against the lenses. For example:

- *Does the action improve quality of life and wellbeing for Black and Indigenous Portlanders that experience the greatest inequality in Portland?*
- *Does it reduce Portland's local carbon emissions?*
- *Does it reduce exploitation of the global workforce?*
- *Does it reduce global carbon emissions produced from consumption by higher income households, business, and governments?*

Although this is a tough test for government actions to pass, it is precisely the level of complexity that public sector decisions must wrestle with to solve challenges like social inequality and climate change. As Raworth says, we must "get savvy with systems" to achieve the level of transformation needed.

The first draft of this work was created by the TCI team. Now Portland can use these lenses and their underlaying data and adjust local targets and indicators to ensure they are accurate and relevant. Resources invested in climate change, sustainable consumption and even economic recovery and development can be tested to see whether they are helping to move toward these targets. The indicators can help determine whether investments are moving Portland to the safe and just space for humanity.

Consumption-based Emissions Background

Portland's consumption-based emissions inventory (CBEI) assesses the global emissions produced as a result of local consumer spending. The CBEI builds on 2005 and 2010 inventories produced by the Oregon Department of Environmental Quality (DEQ). Portland's most current CBEI is based on estimates of Multnomah County consumer spending for 2015, compiled from multiple sources including the U.S. Bureau of Economic Analysis and the U.S. Bureau of Labor Statistics.

The data is based on "final demand," another term for consumption. It includes only the goods, food, materials, and services purchased directly by "end users" or "consumers." Consumers include households and governments. In certain instances, businesses are also counted as consumers. Most purchases by businesses do not contribute to final demand, but rather support final demand as a part of supply chains. However, one category of business purchases is included in final demand: investment purchases, or the equipment or inventory that businesses purchase but do not sell each year. These definitions of "final demand" and "consumers" are consistent with national economic accounting.

The CBEI model also considers usage data for electricity and fuel sales in Multnomah County as well as emissions associated with waste disposed at landfills, both of which are included in traditional sector-based emission inventories. The data includes spending by consumers on 536 different commodities. The model considered the lifecycle emissions of each commodity, specifically looking at five lifecycle phases: production, pre-purchase transportation, wholesale/retail, use and post-consumer disposal. Emissions are calculated using average emission intensities applied to each commodity based on whether the emissions were produced in Oregon, the rest of the United States or elsewhere in the world.

The CBEI relies on models derived from national economic accounts to estimate emissions. The model uses averages: both for what Portland consumers purchase and the emissions associated with producing individual commodities. Portland does not have data or information on individual consumers, and the model does not provide data about individual producers. Individual consumers and producers may both vary widely from the average. However, the use of averages is sufficient for the purpose of a CBEI.

Portland's CBEI is updated and maintained with support from Oregon DEQ.[5] An overview of DEQ's model and methodology as revised for Portland is noted in Appendix 4 of Portland's 2015 Climate Action Plan.[6] More about technical details about the inventory methodology can be found on in Appendix B of the following Oregon Department of Environmental Quality Technical Report: https://www.oregon.gov/deq/FilterDocs/OregonGHGreportAB.pdf

2015 Consumption-based Emissions Inventory

Portland's total 2015 consumption-based emissions can be found in Table 1 below. Portland's consumption-based emissions increased by 9% from 2011 to 2015 (see Figure 1). This increase in emissions may be related to changes in emission intensities for various commodities but is mostly driven by changes in spending between the post-recession 2011 and full economic recovery by 2015. For instance, lifecycle emissions for the Construction sector increased by 47%, as local construction activity increased following the recession. Similar trends are visible in other sectors, such as spending on Healthcare and Services, which would be expected to increase with higher employment rates. CBEI is based on final demand, and as spending by households and governments increases for various categories, that spending is reflected in higher emissions.

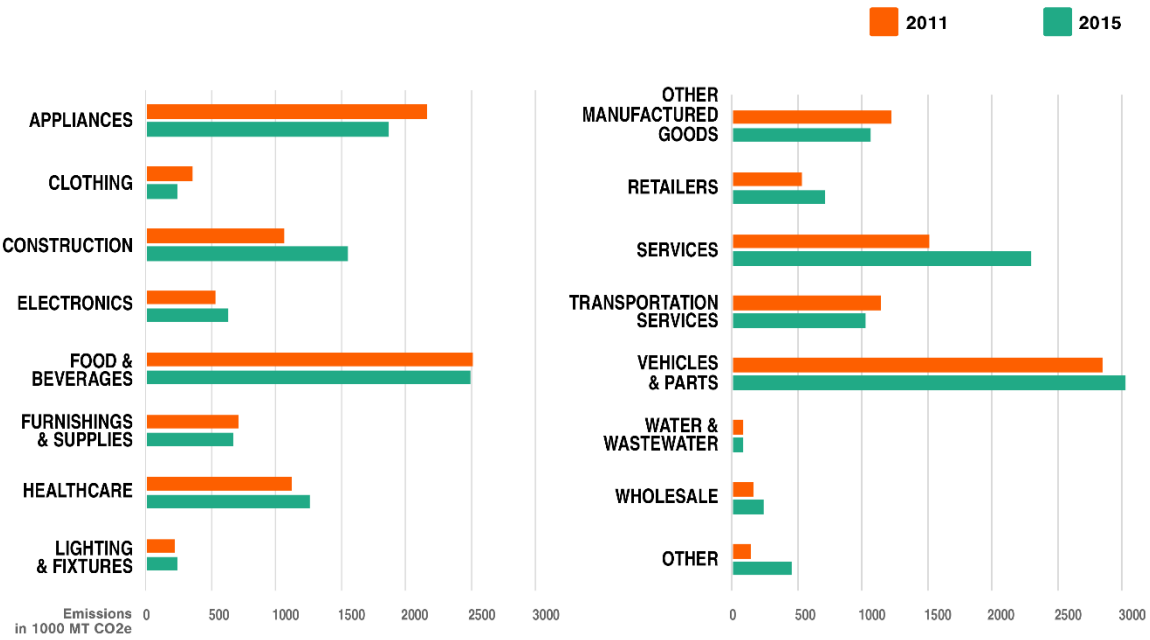

Figure 1: Emissions from Multnomah County by category, comparing changes from 2011 and 2015

Portland's consumption-based emissions inventory provides emissions by lifecycle phase for each commodity and category of spending. On average, 62% of emissions occurring in the production phase and 73% of total emissions produced before a consumer ever purchases a product, see Figure 2 below. About 26% of lifecycle emissions come from the use of products, such as driving a car, powering a computer, turning on heating or lighting or washing clothes. Less than 1% of lifecycle emissions are produced from the disposal of waste products at the end-of-life.

For use phase emissions, just over a quarter of Portland's consumption-based emissions, come from the use of products, and consumers have direct control over those emissions. Therefore, it is valuable to understand the nature of this lifecycle phase ("use phase"). Vehicles, appliances, lighting and electronics all require energy in their use and thus are responsible for the generation of associated carbon emissions.

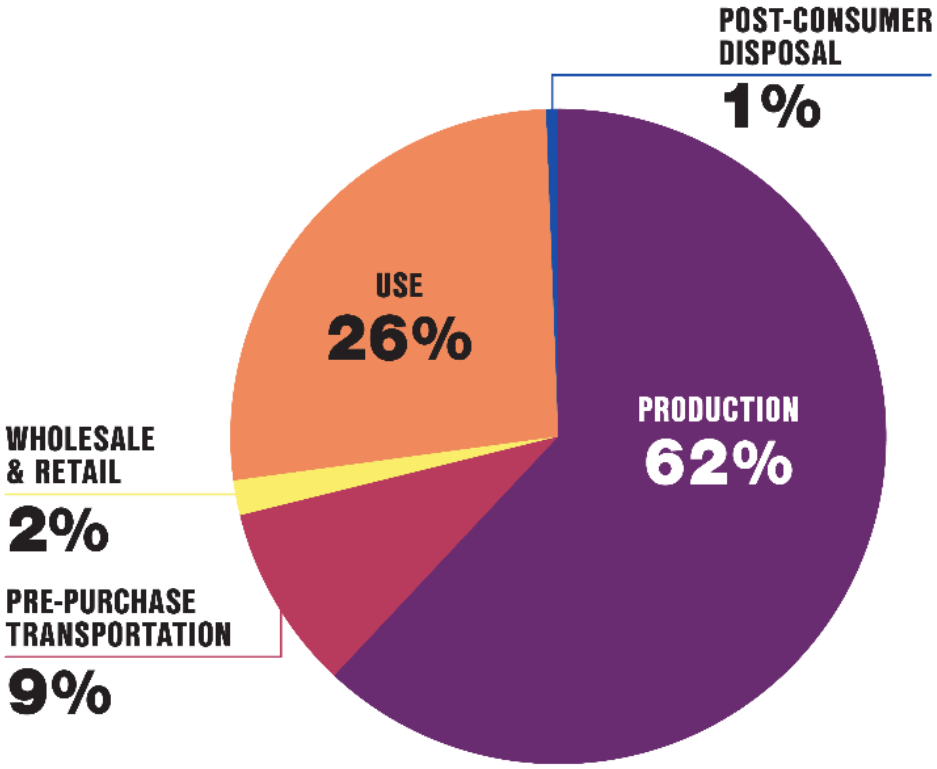

Figure 2: Multnomah County consumption-based emissions by lifecycle phase (2015)

Often, emissions from a product's use can be reduced with common carbon reduction strategies. For example, to reduce emissions from the use of a vehicle, walking and biking are the best options, followed by taking public transit and using biofuels or electric vehicles. Purchasing high-efficiency Energy Star appliances and lighting, unplugging, and turning off electronics, and enrolling in utility green power programs will help to reduce the impact from home energy use. In the case of goods that require the use of appliances, such as washing a pair of jeans, the use phase also creates an opportunity to reduce emissions.

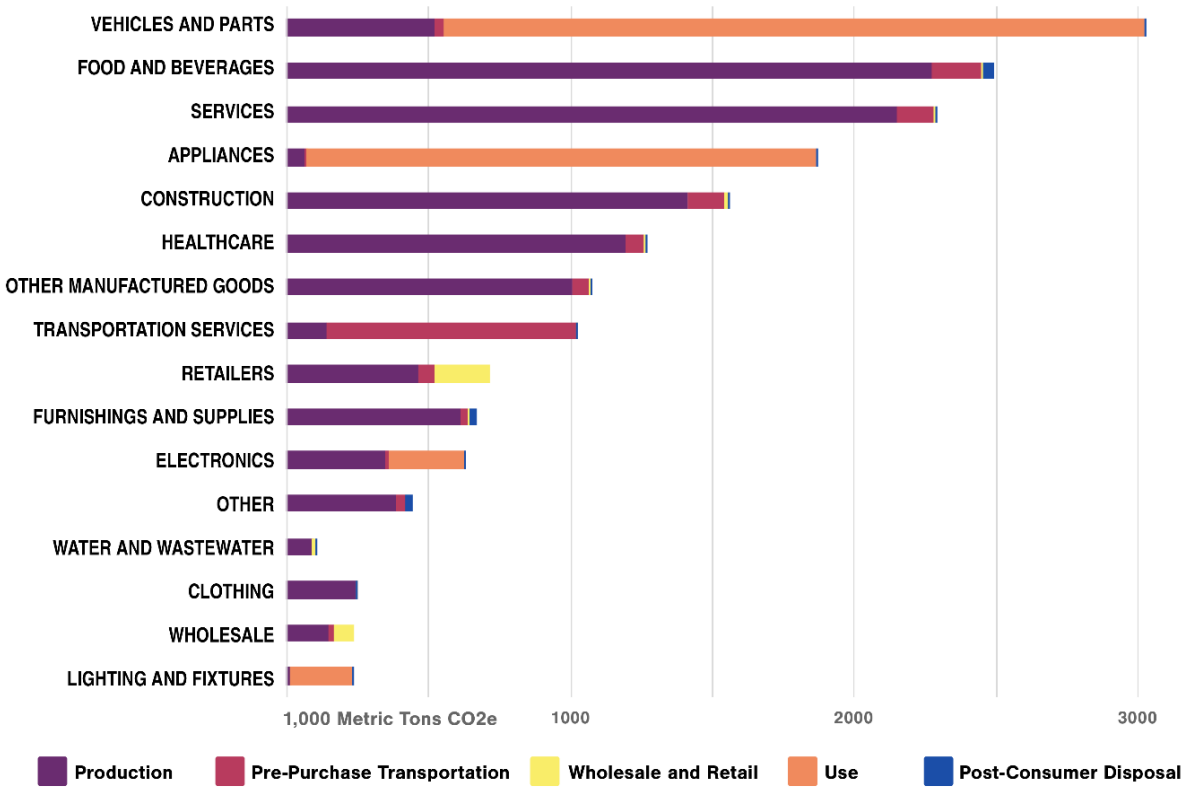

Figure 3: Multnomah County consumption-based emissions by lifecycle phase (2015)

In the case of the lifecycle of a single pair of its jeans, Levi's has estimated each pair produces 72 pounds of lifecycle carbon emissions, with 58% of emissions coming from the use of the jeans if they are washed in warm water and machine-dried once per week.[7] Washing the jeans in cold water and line drying can reduce use phase emissions by 90% — cutting lifecycle carbon emissions in half and likely also extending the life of the jeans. In the CBEI data, the use-phase emissions from a washing machine or other appliance are under the category of Appliances, not Clothing, which means machine washing is captured under Appliances (see Figure 3 and Table 3).

Understanding consumption-based emissions can help consumers tailor solutions to different categories of products based on whether emissions predominantly come from certain lifecycle phases (see Figure 3). For example, vehicles, appliances, and lighting produce more emissions during their use than in their production. Therefore, replacing these aging technologies with new, energy-efficient ones is an important opportunity to reduce carbon emissions. However, for most categories of food, goods, materials, and services, the production phase generates the majority of emissions and therefore

reducing and shifting consumption, including through extending the life of the product by repair and reuse are methods available to consumers to reduce carbon emissions associated with production.

Table 3: Total lifecycle emissions by lifecycle phase, Multnomah County consumption-based emissions (2015).

CATEGORY	Total GHG Emissions*	Production	Pre-Purchase Transportation	Wholesale and Retail	Use	Post-Consumer Disposal	Percent of Total Emissions
Lighting and fixtures	232.1	12.1	0.4	0.0	219.6	0.0	1%
Wholesale	237.0	148.5	19.5	69.0	-	-	1%
Clothing	246.0	244.3	1.3	0.1	-	0.3	1%
Water and wastewater	92.2	91.6	0.6	9.3	-	0.0	1%
Other	447.8	384.6	34.2	2.5	-	26.5	3%
Electronics	625.1	345.8	13.4	0.8	265.0	0.2	4%
Furnishings and supplies	670.5	613.0	27.7	1.4	-	28.4	4%
Retailers	714.2	464.3	57.3	192.5	-	-	4%
Transportation services	1,020.0	139.0	880.0	0.8	-	0.1	6%
Other manufactured goods	1,071.3	1,007.3	59.3	3.2	-	1.4	6%
Healthcare	1,265.5	1,192.0	67.4	4.5	-	1.7	7%
Construction	1,557.6	1,413.3	130.4	10.0	-	3.9	9%
Appliances	1,863.0	65.4	2.8	0.2	1,794.3	0.4	10%
Services	2,290.6	2,148.6	131.2	4.7	-	6.0	13%
Food and beverages	2,490.6	2,271.6	175.3	6.2		37.5	14%
Vehicles and parts	3,018.2	521.5	33.6	2.3	2,460.2	0.7	17%
TOTAL	**17,841.8**	**11,062.9**	**1,634.5**	**307.5**	**4,739.1**	**107.2**	100%
Percent of Total Emissions	**100%**	**62%**	**9%**	**2%**	**27%**	**1%**	
*1000 Metric tons CO2e							

2011 Updated Emissions Inventory Data

Table 4: Total updated lifecycle emissions by lifecycle phase, Multnomah County Consumption-based Emissions (2011). 2011 emissions were updated to align with a new methodology implemented by Oregon Department of Environmental Quality for the 2015 inventory.

CATEGORY	Total GHG Emissions*	Production	Pre-Purchase Transportati	Wholesale and Retail	Use	Post-Consumer Disposal	Percent of Total Emission
Water and wastewater	78	77	1	-	-	0	0%
Other	141	131	10	0	-	0	1%
Wholesale	162	80	13	70	-	-	1%
Lighting and fixtures	220	9	0	0	211	0	1%
Clothing	365	362	2	0	-	1	2%
Retailers	529	319	37	173	-	-	3%
Electronics	537	348	10	1	178	0	3%
Furnishings and supplies	722	672	32	1	-	17	4%
Construction	1,061	964	78	4	-	15	6%
Healthcare	1,128	1,064	60	3	-	1	7%
Transportation services	1,145	68	1,077	0	-	0	7%
Other manufactured goods	1,219	1,164	52	2	-	1	7%
Services	1,505	1,406	94	2	-	4	9%
Appliances	2,163	62	2	0	2,099	0	13%
Food and beverages	2,509	2,316	150	4	-	39	15%
Vehicles and parts	2,853	283	14	1	2,556	0	17%
TOTAL	**16,337**	**9,325**	**1,630**	**261**	**5,044**	**78**	
Percent of Total Emissions	**100%**	**57%**	**10%**	**2%**	**31%**	**0.5%**	
*1000 Metric tons CO2e							

CBEI detailed emission tables by category – 2015

Multnomah County CBEI data is provided in the following tables for three-phase emissions, or emissions from the upstream lifecycle phases (production, pre-purchase transportation, and wholesale and retail distribution). These emissions were used to prioritize actions and approaches for the Sustinable Consumption and Production Report. The intent of the Sustainable Consumption and Production Report was to focus on new areas of innovation for cities, by exploring opportunities outside of traditional climate planning. The lifecycle phases that are downstream from consumers (use and disposal) are well understood and addressed in Portland's Climate Action Plan, Climate Emergency Declaration and 100% Renewable Resolution.

The following tables are ordered by category and show total emissions by commodity, emissions by production geography (in Oregon, rest of USA, or Foreign), and Institution of Demand (Household, Government, Business Investment).

Three-phase emissions from food and beverages

Units in 1000 MT CO2e	**Totals**		**Emissions by Production Geography**			**Emissions by Institution Demand**		
Food	GHG Emissions	Total Share	In-State	Other 49	Foreign	Household	Government	Investment
Other Meat (Beef, Pork, etc.)	505.1	27.9%	1.3	422.9	80.9	448.9	53.2	3.0
Dairy	318.0	17.6%	3.3	293.1	21.6	282.1	33.7	2.2
Grains, Baked Goods, Cereals, Nuts	212.7	11.7%	3.6	145.3	63.8	199.5	10.1	3.0
Restaurants	176.5	9.7%	33.5	4.0	139.0	168.7	6.5	1.2

Fruit and Vegetables	150.9	8.3%	1.5	97.5	51.9	144.3	6.0	0.6
Other Food and Agriculture	141.5	7.8%	1.1	122.4	18.0	124.2	8.8	8.5
Other Animal Products	81.1	4.5%	0.5	77.8	2.9	73.2	7.0	0.9
Beverages	73.7	4.1%	6.2	9.4	58.0	72.2	1.5	0.0
Condiments, Oils and Sweeteners	58.9	3.3%	0.3	42.5	16.1	53.9	3.6	1.4
Poultry and Eggs	39.8	2.2%	0.0	30.1	9.7	38.3	1.4	0.2
Pet Food	26.7	1.5%	1.1	3.4	9.5	13.6	0.4	0.0
Other Frozen Food	14.0	0.8%	1.1	3.4	9.5	13.6	0.4	0.0
Seafood	11.6	0.6%	0.3	2.1	9.2	9.5	2.1	0.0
Food Total	1810.3	100.0%	53.7	1253.9	490.1	1641.9	134.7	21.0

Three-phase emissions from construction

Units in 1000 MT CO2e	**Totals**		**Emissions by Production Geography**			**Emissions by Institution Demand**		
Industry Sector	GHG Emissions	Total Share	In-State	Other 49	Foreign	Household	Gov.	Business
Materials manufacturing								

205 - Cement manufacturing	145.6	14.6%	0.0	145.6	0.0	35.7	40.3	69.6
210 - Lime manufacturing	14.0	1.4%	3.8	10.0	0.2	8.2	1.5	4.3
206 - Ready-mix concrete manufacturing	5.8	0.6%	0.7	5.1	0.0	1.2	1.5	3.0
209 - Other concrete product manufacturing	2.5	0.2%	0.0	2.4	0.0	0.5	0.8	1.1
211 - Gypsum product manufacturing	1.1	0.1%	0.1	0.9	0.0	0.5	0.2	0.4
207 - Concrete block and brick manufacturing	1.0	0.1%	0.0	1.0	0.0	0.3	0.3	0.5
208 - Concrete pipe manufacturing	0.5	0.0%	0.1	0.4	0.0	0.1	0.2	0.2
Non-Res. Construction								
58 - Construction, other new nonresidential structures	133.0	13.3%	61.1	0.5	71.4	0.0	65.1	67.9
57 - Construction, commercial structures	65.4	6.5%	30.3	0.0	35.0	0.0	6.8	58.5
56 - Construction, new highways and streets	63.5	6.4%	24.4	0.0	39.1	0.0	62.9	0.7

62 - Maintenance & repair, nonresidential structures	54.3	5.4%	26.9	18.9	8.4	31.4	18.3	4.5
55 - Construction, new educational/vocational structures	49.3	4.9%	19.9	0.2	29.1	0.0	43.9	5.3
54 - Construction, new power & communication structures	45.4	4.5%	22.5	0.0	22.9	0.0	6.8	38.6
64 - Maintenance & repair highways, streets, bridges, & tunnels	40.9	4.1%	17.4	0.2	23.2	0.0	40.9	0.0
53 - Construction, new manufacturing structures	36.6	3.7%	18.8	0.0	17.7	0.0	0.5	36.0
52 - Construction, new health care structures	22.5	2.3%	9.9	0.0	12.6	0.0	5.6	16.9
Residential Construction								
61 - Construction, new residential structures	142.8	14.3%	55.1	0.0	87.7	0.0	0.5	142.3
59 - Construction, new single-family residential structures	119.0	11.9%	58.3	0.0	60.8	0.0	0.4	118.6

60 - Construction, new multifamily residential structures	31.7	3.2%	12.8	0.0	18.9	0.0	4.1	27.6
63 - Maintenance & repair construction of residential structures	23.2	2.3%	21.1	1.4	0.8	21.3	1.6	0.4
CONSTRUCTION TOTAL	998.0	100%	383.	186.9	427.9	99.2	302.4	596.4

Three-phase emissions from services and healthcare

Units in 1000 MT CO2e	**Totals**		**Emissions by Production Geography**			**Emissions by Institution Demand**		
Services & Healthcare Sector	GHG Emissions	Total Share	In-State	Other 49	Foreign	Household	Gov.	Business
Other Services	331.4	16.9%	103.2	66.1	162.2	196.4	58.7	76.3
Healthcare Services	262.6	13.4%	101.4	3.3	158.0	261.1	1.5	0.0
Medicines	232.4	11.8%	1.2	49.8	181.5	226.6	5.4	0.4
Legal, Real Estate, Insurance	231.7	11.8%	98.8	19.0	113.9	185.4	16.8	29.5
Entertainment and Media	148.2	7.6%	20.6	49.2	78.4	126.0	12.3	9.9
Education and Day Care	116.3	5.9%	34.5	16.8	65.0	113.5	2.6	0.1
Banks and Financial Services	87.3	4.4%	35.3	25.3	26.7	81.9	2.5	2.9
Hotels and Motels	48.0	2.4%	0.2	24.7	23.1	44.0	2.9	1.1

Personal Services	36.8	1.9%	8.7	1.2	26.8	35.7	1.0	0.1
Car Rental, Repair and Wash	28.0	1.4%	9.2	2.8	16.1	26.9	0.6	0.5
Building Services	11.6	0.6%	3.7	3.6	4.3	7.8	3.2	0.6
Services & Healthcare Total	1961.5	100.0%	102.5	53.0	339.4	487.8	6.9	0.4

Three-phase emissions from manufactured goods

Units in 1000 MT CO2e	**Totals**		**Emissions by Production Geography**			**Emissions by Institution Demand**		
Manufactured Goods Sector	GHG Emissions	Total Share	In-State	Other 49	Foreign	Household	Gov.	Business
Other Manufactures*	652.5	49.5%	12.5	403.2	236.8	365.4	126.5	160.6
Machinery Manufacturing	294.6	22.4%	2.0	33.0	259.6	16.9	29.6	248.0
Foundries, Metal Processing	202.0	15.3%	0.9	198.9	2.3	78.2	28.1	95.8
Heavy Transportation Equipment	97.2	7.4%	7.3	6.3	83.5	0.7	15.6	80.9
Forestry, Mills, Paper	61.0	4.6%	0.6	56.9	3.5	38.6	10.5	11.8
Missiles, Weapons	8.5	0.6%	0.0	1.7	6.8	3.0	5.4	0.1
Mobile Homes	1.5	0.1%	0.0	0.3	1.2	0.0	0.4	1.1
Manufactured Goods Total	1317.3	100.0%	23.2	700.4	593.7	502.8	216.1	598.3

Three-phase emissions from furnishings and supplies

Units in 1000 MT CO2e	Totals		Emissions by Production Geography			Emissions by Institution Demand		
Furnishings and Supplies Sector	GHG Emissions	Total Share	In-State	Other 49	Foreign	Household	Gov.	Business
Household Supplies	168.6	31.8%	1.3	60.7	106.6	143.2	15.9	9.5
Furnishings	136.0	25.7%	0.2	10.5	125.3	103.8	5.3	27.0
Office Supplies	92.0	17.4%	7.0	62.2	22.9	61.9	19.8	10.3
Media	75.6	14.2%	5.1	7.8	62.7	63.9	3.1	8.6
Lawn and Garden	58.2	11.0%	1.7	46.5	10.0	44.5	7.2	6.5
Furnishings & Supplies Total	530.3	100.0%	15.3	187.7	327.3	417.3	51.2	61.8

Three-phase emissions from clothing

Units in 1000 MT CO2e	Totals		Emissions by Production Geography			Emissions by Institution Demand		
Clothing Sector	GHG Emissions	Total Share	In-State	Other 49	Foreign	Household	Gov.	Business
128 - Womens and girls cut and sew apparel manufacturing	79.0	33.2%	0.1	0.3	78.6	77.6	1.4	0.0
132 - Footwear manufacturing	54.0	22.7%	0.0	0.1	53.9	53.9	0.1	0.0

127 - Mens and boys cut and sew apparel manufacturing	43.6	18.3%	0.0	0.1	43.4	43.5	0.0	0.0
133 - Other leather and allied product manufacturing	34.3	14.4%	0.0	0.1	34.3	34.0	0.1	0.2
130 - Apparel accessories and other apparel manufacturing	12.7	5.3%	0.0	0.1	12.6	12.5	0.2	0.0
124 - Hosiery and sock mills	7.1	3.0%	0.0	0.0	7.0	6.9	0.1	0.0
129 - Other cut and sew apparel manufacturing	6.6	2.8%	0.0	0.1	6.5	6.6	0.0	0.0
126 - Cut and sew apparel contractors	0.8	0.3%	0.0	0.1	0.7	0.1	0.7	0.0
125 - Other apparel knitting mills	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Clothing Total	238.0	100.0%	0.2	0.8	237.1	235.1	2.7	0.2

Three-phase emissions from electronics

Units in 1000 MT CO2e	**Totals**		**Emissions by Production Geography**			**Emissions by Institution Demand**		
Industry Sector	GHG Emissions	Total Share	In-State	Other 49	Foreign	Household	Gov.	Business
Computer Service & Equipment								
451 - Custom computer programming services	35.8	14.9%	13.1	0.1	22.6	0.1	4.1	31.6

452 - Computer systems design services	12.6	5.2%	3.6	1.3	7.7	1.8	8.3	2.4
430 - Data processing, hosting, and related services	8.3	3.5%	2.7	2.3	3.3	3.1	4.6	0.6
453 - Other computer related services, including facilities management	3.4	1.4%	1.8	1.0	0.6	1.8	1.2	0.4
Computers & Peripherals								
301 - Electronic computer manufacturing	39.2	16.3%	0.0	6.2	33.0	14.7	4.7	19.8
303 - Computer terminals and other computer peripheral equipment manufacturing	10.6	4.4%	0.0	0.6	10.0	5.7	1.5	3.5
302 - Computer storage device manufacturing	6.3	2.6%	0.0	1.5	4.8	2.2	1.2	3.0
Other Electronics								
307 - Audio and video equipment manufacturing	63.8	26.6%	0.0	0.2	63.6	45.6	7.0	11.3
305 - Broadcast and wireless communications equipment manufacturing	54.4	22.6%	0.0	0.1	54.3	8.5	14.3	31.6
304 - Telephone apparatus manufacturing	3.7	1.5%	0.0	0.4	3.2	0.3	0.9	2.5
273 - Photographic and photocopying equipment manufacturing	2.2	0.9%	0.0	0.1	2.1	0.9	0.2	1.2
ELECTRONICS TOTAL	240.4	100%	21.3	13.9	205.2	84.7	47.9	107.8

Three-phase emissions from appliances

Units in 1000 MT CO2e	Totals		Emissions by Production Geography			Emissions by Institution Demand		
Appliances Sector	GHG Emissions	Total Share	In-State	Other 49	Foreign	Household	Gov.	Business
327 - Small electrical appliance manufacturing	21.0	36.5%	0.0	0.0	21.0	19.5	0.5	1.1
329 - Household refrigerator and home freezer manufacturing	10.7	18.6%	0.0	0.4	10.3	7.3	0.5	2.9
328 - Household cooking appliance manufacturing	9.7	16.8%	0.0	0.3	9.3	7.2	0.3	2.2
277 - Air conditioning, refrigeration, and warm air heating equipment manufacturing	7.3	12.7%	0.1	1.4	5.8	1.5	1.1	4.7
330 - Household laundry equipment manufacturing	5.3	9.3%	0.0	0.5	4.9	5.0	0.0	0.3
331 - Other major household appliance manufacturing	2.1	3.6%	0.0	0.2	1.9	1.4	0.0	0.7
276 - Heating equipment (except warm air furnaces) manufacturing	1.4	2.5%	0.0	0.2	1.3	1.3	0.1	0.1
APPLIANCES TOTAL	57.5	100.0%	0.1	3.0	54.4	43.1	2.5	11.9

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